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TRANSLATION OF DOCUMENT 1 (Utility Model Publication 8-3631)

5 (THE NAME OF DOCUMENT) UTILITY MODEL PUBLICATION
(FILING DATE) March 28, 1989
(FILING NUMBER) 1-35245
10 (THE TITLE OF THE INVENTION) DOOR LOCKING APPARATUS
(THE NUMBER OF CLAIMS) 2
(PUBLICATION DATE) October 25, 1990
15 (PUBLICATION NUMBER) 2-129570
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40 (54) [Title of the Invention] Door Locking Apparatus
[Scope of the Claims]

[Claim 1] A door locking apparatus having a housing containing: a lever member, for
performing locking/unlocking actions of a door, supported on a support shaft so as to be
able to swing between a locking position and an unlocking position; a drive motor
45 mounted on the housing; a speed reducing mechanism for transmitting rotational torque
of the drive motor to the lever so as to swing the lever to respective positions, wherein a
feature of the apparatus is that at least one of the gears comprising the speed reducer is
formed integrally on the housing.

[Claim 2] A door locking apparatus according to claim 1, wherein the speed reducing mechanism is a planetary gear arrangement, and said at least one gear is an inner gear serving as the sun gear in the planetary gear arrangement.

[Field of Industrial Application]

5 In the present practical utility model, a lever member is supported inside a housing centered about a shaft axis of a door locking/unlocking apparatus so as to be freely swinging between a locking position and an unlocking position, and a drive motor is attached to the housing in such a way that the rotational force of the drive motor is transmitted to the lever member through a speed reducer so that the lever member can
10 swing to each location.

[Conventional Technology]

An example of a conventional door locking apparatus is shown, for example, in a Japanese Practical Utility Model, Show 62-71251.

That is, the locking/unlocking lever is placed inside the housing so that the lever can
15 swing between the locking position and the unlocking position about the support shaft, and an output member is connected to the base end section of the locking/unlocking lever. When the output member swings about the rotation axis, the locking/unlocking lever is made to move. The drive motor is attached to the outer wall side of the boundary wall of the housing, and the drive power of the drive motor is transmitted to
20 the output member through the speed reducer, which is a gear train comprised by a series of successive gears contained in the housing.

[The Problem to be Solved]

However, according to such a conventional door locking apparatus, the size of the speed reducer is large because it is comprised by many gears so that it is not only unsuitable
25 for making a compact door locking apparatus but is costly for the apparatus.

The present invention is provided in view of the background described above, and an object is to provide a compact door locking apparatus that achieves a compact size and low cost by reducing the number of gears comprising the speed reducer as well as by employing a planetary gear arrangement to further reduce the size of the overall door
30 locking apparatus.

[Means for Solving the Problem]

The essential features of the present invention to achieve the objectives are:

1. In a door locking apparatus having a housing that contains: a lever member, for performing locking/unlocking actions of a door, supported on a support shaft so as to be
35 able to swing between a locking position and an unlocking position; a drive motor mounted on the housing; a speed reducing mechanism for transmitting rotational torque

of the drive motor to the lever so as to swing the lever to respective positions, wherein a feature of the apparatus is that at least one of the gears comprising the speed reducer is formed integrally on the housing; and,

2. In the door locking apparatus according to claim 1, the speed reducing mechanism is a planetary gear arrangement, and said at least one gear is an inner gear serving as the sun gear in the planetary gear arrangement.

[Operational Effects]

The gears that constitute the speed reducer are integrally fabricated on the housing, and the speed of the rotation motor is controlled suitably by those gears. Accordingly, the power of rotation produced by the drive motor is reduced to a speed suitable for moving the lever member from the locking position to the unlocking position or vice versa.

[Preferred Embodiments]

In the following, one example of the practical utility model will be explained with reference to the drawings.

Each drawing refers to an embodiment of the practical utility model.

As can be seen in Figures 1 and 4, the striker is omitted from the drawings, but it is fixed to the body panel, and the door locking apparatus 10 is disposed on the end surface of the door that faces the striker.

The gear mechanism and the operational mechanism of the door locking apparatus 10 are contained inside the housing 20. The housing 20 has a housing section 20a comprised by a base plate 21 coupled to a cover plate 22 for the purpose of housing the gearing mechanism. The cover plate 22 and a resin cover 23 are coupled to serve as a housing section 20b for the operational mechanisms.

A resin body 24 fills the space between the outer surface of the inner space of the gearing mechanism housing section 20a and the gearing mechanism.

An entry groove 25 for the striker is formed on the location of the resin body 24 corresponding to the front surface of the housing section 20a for the gearing mechanism and on the location corresponding to the bottom surface of the base plate 21.

A latch 31 for detachingly engaging with the striker and a locking plate, which is omitted from the drawing, are contained in the inside of the housing section 20a for housing the gearing mechanism.

The latch 31 is axially supported by a support shaft 41 that bridges the base plate 21 and the cover plate 22, and is biased in the direction of the opening of the entry groove 25 by means of a biasing spring, which is omitted from the drawing.

The locking plate is similarly supported by a support shaft 42 that bridges the base plate 21 and the cover plate 22, and is biased in the direction of engaging with the latch 31

which is omitted from the drawing. The locking plate has an engaging end, for engaging with an engaging end of the latch 31, and an operational end 33.

The operational end 33 of the locking plate extends through the through-hole of the cover plate 22 into the interior of the housing section 20b, and the operational mechanisms for operating the operational end 33 are provided on the foundation of the attaching wall 26 erected by bending the rear edge of the cover surface of the resin cover 23. Similarly, the attaching wall 26 of the resin cover 23 covers the wall section 22a erected by bending the rear edge of the cover surface of the cover plate 22.

The operational mechanisms are comprised by an opening lever 51 for unlocking the door, a connecting lever 52 and a locking/unlocking lever 53. The opening lever 51 is supported on the support shaft 4 embedded in the attaching wall 26, and the locking/unlocking lever 53 is supported similarly by the support shaft 27 formed on the attaching wall 26.

The opening lever 51 has an operational end 51a connected to the inside handle provided in the interior of the vehicle, which is an unlocking means, which is omitted in the diagram, and the opposite end 51b is fixed to the base end 52a of the connecting lever 52, which is biased by the biasing spring in the clockwise direction when viewing in the A-direction in Figure 4.

The connecting lever 52 has an operational end 52b in the middle section to detachably engage with the operational end 33 of the locking plate 32, and a longitudinal hole 52c is formed at the leading end.

The locking/unlocking lever 53 is able to swing about the support shaft 27, and is biased by a reversing spring so as to reverse and retain respective locking/unlocking positions, such that a pin member 53a embedded in the operational end couples in the longitudinal hole 52c of the connecting lever 52 to permit it to slide in the hole. A through-hole 53b is formed in the upper end of the locking/unlocking lever 53 to couple in the bottom end of an operational rod, which is located beyond the diagram, and the bottom end section serves as the manual locking/unlocking end 53c linked to the key cylinder.

As shown in Figures 1~3, on the inner wall of the attaching wall 26 of the resin cover 23, an attaching seat 26a is formed to extend into the housing section 20b for containing the operational mechanisms.

On the attaching seat 26a, a through-hole 28 is formed to extend from the housing section 20b side to the outer wall of the attaching wall 26. The leading end of the through-hole 28 is formed into a large diameter section 29, which is larger than the diameter of the base section side.

The locking/unlocking lever 53 is located tightly in the through-hole 28 so that the

locking/unlocking lever 53 will be able to rotate with the support shaft 27.

An output shaft 71 of the drive motor 70 is disposed on the axial center line of the support shaft 27. The support shaft 27 is linked so as to be driven by means of the planetary gearing mechanism 80, that serves as the speed reducer, in such a way that the drive motor 70 and the planetary gear mechanism 80 are contained inside the casing 90.

At the leading end of the support shaft 27, a circular input plate 81 serving as a part of the planetary gear mechanism 80 is formed integrally therewith. The locking/unlocking lever 53 on the base end side of the support shaft 27 abuts the attaching seat 26a as well as the step section 29b existing between the through-hole 28 and the large diameter section 29, thereby preventing the support shaft 27 from slipping out of the through-hole 28.

Four pin members 82 are embedded around the periphery section of the circular input plate 81 and the tips of the pin members 82 is oriented roughly horizontally. An inner gear 83 are formed on the inner wall of the large diameter section 29 to serve as the sun gear.

Planetary gears 84 are disposed opposite to the circular input plate 81, and each planetary gear is provided with a coupling hole 85 for loosely coupling with each pin member 82. A circular intermediate plate 86 is fixed to the output shaft 71 of the drive motor 70. A rotation shaft section 87 protrudes from the intermediate circular plate 86 in an offset location, away from the center line of the output shaft 71, and the planetary gears 84 are rotatably supported on the rotation shaft section 87.

That is, the support shaft 27 is rotated by the actions of the coupling holes 85~pin members 82~circular intermediate plate 81, by the rotating action of the inner gear 83 engaging with the planetary gears 84.

The attachment flange 91 of the casing 90 is riveted to the outer wall of the attaching wall 26. The lead wires 75 extend from the rear opening section of the casing 90 to an electrical source, which is omitted from the diagram.

Next, the operational effects of the locking apparatus will be explained.

To mount the drive motor 70 and others to the housing 20, the locking/unlocking lever 53 is supported on the support shaft 27 on the attaching wall 26 of the resin cover 23 so as to swing freely, and the circular input plate 81 is fixed to the tip of the support shaft 27.

Next, the casing 90, having the drive motor 70 and others mounted therein, is placed in proximity to the attaching wall 26 so that the coupling holes 85 of the planetary gears 84 correspond with the pin members 82 on the circular input plate 81 to enable to insert the pin members 82 into the coupling holes 85.

When the pin members 82 are coupled in the coupling holes 85, the attachment flange 91 of the casing 90 intimately contacts the outer wall of the attaching wall 26, so that it is possible to confirm easily that the pin members 82 have been fitted into the coupling holes 85. Next, by riveting the attachment flange 91 to the attaching wall 26, the drive motor 70 and others can readily be mounted on the housing 20.

As described above, according to the door locking apparatus 10 having the drive motor 70 and others mounted on the housing 20, when the drive motor 70 is operated so as to place the door locking apparatus 10 from the locking state to the unlocking state, the circular intermediate plate 86 rotates with the output shaft 71 as a unit about its center of rotation.

When the circular intermediate plate 86 rotates, the planetary gears 84, coupling with the inner gear 83, rotate about the center of the rotation shaft section 87 in the clockwise direction when viewing in the A1 direction in Figure 2. Accordingly, the periphery section of the coupling holes 85 moves in contact with the pin members 82. As the pin members 82 displace, the support shaft 27 rotates by the action of the circular input plate 81.

By so doing, the locking/unlocking lever 53 swings in the clockwise direction about the support shaft 27, thereby changing the apparatus from the locking state to the unlocking state. In this condition, when the inner handle which is beyond the diagram is operated so that the opening lever 51 is swung in the clockwise direction in Figure 4, the connecting lever 52 pushes the operational end 33 of the locking plate 32. By so doing, the locking plate detaches from the latch 31 so that the latch 31 swings and detaches from the striker.

Conversely, to change the locking apparatus 10 from the unlocking state to the locking state, the drive motor 70 is operated so that the planetary gears 84 which are coupled with the inner gear revolve in the counter clockwise direction as viewed in the A1 direction in Figure 2.

In the previous embodiment, although the speed reducer is served by the planetary gear mechanism 80, it may be a general gear mechanism, and furthermore, the planetary gear mechanism 80 may be disposed inside the housing 20. Further, although the inner gear 83 was disposed on the outer wall of the attaching wall 26, it may be disposed on the inner wall, and it is not necessary to limit to the inner gear 83 so that an outer gear may be used.

According to the door locking apparatus described in the above embodiment, because the inner gear 83 is formed on the attaching wall 26 of the resin cover 23, product forming operation is facilitated.

[Effects of the Utility Model]

According to the door locking apparatus of the present practical utility model, because the gears that constitute the speed reducing mechanism are fabricated inside a housing, the number of gears is reduced and the size of the speed reducer is made smaller, thereby enabling to reduce the size of the overall apparatus as well as the cost of the apparatus. Further, because the planetary gear arrangement is used for the speed reducing mechanism, the speed reducing mechanism has been made smaller still, thus enabling to reduce the size of the overall apparatus still further.

[Simple Explanation of the Drawings]

Figures 1~4 relate to an embodiment of the present practical utility model, where Figure 1 shows an overall perspective view of the door locking apparatus; Figure 2 shows a cross sectional view of key elements of the same apparatus; Figure 3 shows a front view of a portion of the planetary gear mechanism; and Figure 4 shows an exploded perspective view of the door locking apparatus.

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|----|-------------------------|----|-----------------|
| 10 | door locking apparatus, | | |
| 20 | housing, | 21 | base plate, |
| 22 | cover plate, | 23 | resin cover, |
| 24 | resin body, | 26 | attaching wall, |
| 20 | 27 support shaft, | 31 | latch. |

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